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NOVEMBER 16, 198

& ENGINE

NEW

National Chemistry Day celebrated in variety of events
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PESTICIDES

Agricultural chemicals industry yields to consolidation, slower growth
Page 35

CHEMICAL & ENGINEERING
NEWS
NOVEMBER 16, 1987

Volume 65, Number 46
CENEAR 65 (46) 1–88
ISSN 0009-2347

News of the Week

■ **U.S. and Japan move toward a new pact on science exchanges, giving stronger coordinating role to the Office of Science and Technology Policy.** **Page 4**

■ **Soviet chemical warfare experts are scheduled to tour a U.S. chemical arms facility in Utah later this week.** **Page 5**

■ **EPA orders Texas Eastern Transmission Corp. to clean up 89 sites along 10,000-mile natural gas pipeline that were contaminated by polychlorinated biphenyls, imposes $15 million fine.** **Page 5**

■ **Federal agencies charged with protecting public from chemical hazards are failing to systematically regulate carcinogenic chemicals, says an OTA report.** **Page 5**

■ **Mobay acquires Houston-based Denka Chemical, expanding its U.S. foam cushion business and maleic anhydride operations.** **Page 6**

■ **The Center for History of Chemistry receives a $2 million challenge grant from the Arnold and Mabel Beckman Foundation.** **Page 6**

Cover: Apple orchard being sprayed with pesticide. Photo by Meliott/ Uniphoto Picture Agency

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Business

Major chemical companies' earnings increased 58% in the third-quarter, but certain markets declined. **Page 10**

Government

Proposed right-to-know trade secret rule delineates criteria to be used in "up front" claims of chemical confidentiality. **Page 18**

Science

Shorter, less technical version of Pimentel Report is aimed at high school students, college nonscience majors, and their teachers. **Page 28**

Pacific basin groups form polymer federation to advance and benefit polymer science and technology. **Page 30**

ACS News

National Chemistry Day was marked by public exhibits, workshops, tours, demonstrations, and variety of other events. **Page 52**

Awards

ACS winners: Marcus, Rabo, Robins, Slichter, Smith, Turro, Wender, Winans, and Wrighton. **Page 71**

Product Report

Agricultural pesticides industry experiences slowed growth as a result of persisting surpluses, reduction of planted acreage, increased environmental and safety awareness, and cost-cutting practices by farmers. **Page 35**

Chemical & Engineering News

1155—16th St., N.W., Washington, D.C. 20036

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Published by
AMERICAN CHEMICAL SOCIETY
(202) 872-4600; TDD (202) 872-8733
John K Crum, Executive Director

PUBLISHING BOARD: Barbara G. Wood (*Chairman*); *Board of Directors Chairman:* Ernest L. Eliel; *President:* Mary L. Good; E. E. McSweeney; John H. Nelson; Louis D. Quin; and Jean'ne M. Shreeve

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Subscription Rates 1987. Printed editions: nonmembers U.S. 1 yr. $44, 2 yr. $75, outside U.S. 1 yr. $70, 2 yr. $127. Air freight rates available on request. Rates above do not apply to nonmember subscribers in Japan, who must enter subscription orders with Maruzen Co. Ltd., 3-10 Nihonbashi 2-chome, Chuo-ku, Tokyo 103, Japan. Tel: (03) 272-7211. Single copies: Current $6.00. Rates for back issues and volumes are available from Microforms & Back Issues Office, ACS, 1155—16th St., N.W., Washington, D.C. 20036. Back and current issues available on microfilm and microfiche. Rates on request from Microform Program, ACS.

Chemical & Engineering News (ISSN 0009-2347) is published weekly except for the last week in December by the American Chemical Society at 1155—16th St., N.W., Washington, D.C. 20036. Second-class postage paid at Washington, D.C., and additional mailing offices. POSTMASTER: Send address changes to Chemical & Engineering News, Membership & Subscription Services, P.O. Box 3337, Columbus, Ohio 43210. ACS assumes no responsibility for the statements and opinions advanced by the contributors to its publications.

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LETTERS

Chemical misnomer

SIR: As I have maintained for quite some years, the American Chemical Society is a misnomer and a disadvantageous one.

Ours is a scientific society concerned with the progress of the science of chemistry—not just with compounds and commodities. As such, it would be much more accurately called the American Chemistry Society.

With the launching of National Chemistry Day (it would have been absurd to call it National Chemical Day) perhaps my recommendation will win serious consideration by ACS officers.

As it stands, the term American Chemical Society is, to my mind, woefully inaccurate, a misnomer, and an anachronism.

Alec Jordan
Guilford, N.H.

Women in chemistry

SIR: Thank you for noting in your editorial (C&EN, Sept. 14, page 3) that Jacqueline Barton was honored with the 1988 ACS Award in Pure Chemistry. Not only is this just the second time a woman has received an ACS award for pure research, but it is also the first year in which women have won three ACS awards. Marjorie Gardner received the award in Chemical Education and Marye Anne Fox won the Garvan Medal. Although they have not captured research awards, the Garvan medalists have made important contributions to chemical research, applied fields, and education.

In the past 10 years, the percentage of women obtaining degrees in chemistry has indeed increased substantially. Most of this increase, however, has been due to growth in the number of women attending college rather than to an increasing preference for science among young women. In the past few years the number of women obtaining degrees in chemistry has been steady, and the observed percentage increase is attributable to a decline in the number of men entering the field.

The problem of attracting young people to the pursuit of chemistry is general. Apparently we have not been successful in convincing higher proportions of women, blacks, or Hispanics that science is an exciting, meaningful, and satisfying pursuit. Indeed, we have not competed effectively with other disciplines in attracting young men.

The Women Chemists Committee is compiling suggestions for ways ACS can encourage women to enter and persist in chemistry. We hope that many of the ideas will be helpful to other minority groups and to young people generally. If you have suggestions we should consider, please send them to the Women Chemists Committee, ACS headquarters.

Margaret A. Cavanaugh
Chairman, Women Chemists Committee
Saint Mary's College
Notre Dame, Ind.

Biological detectors

SIR: The article by Pamela S. Zurer, "GC Technique Quantitates Odor-Active Substances in Food" (C&EN, Sept. 28, page 21), describing the "charm analysis" techniques used at Cornell University's department of food science and technology, illustrates the progress made in the use of biological objects as detectors for gas chromatography.

The earliest reported use of biological objects as detectors for gas chromatography was in the late 1950s or early 1960s. In that work the researchers chromatographed extracts of female moths and placed a male moth in the effluent stream from the column. As components of the extract were eluted from the column, those that were sexual attractants caused the male moth to exhibit varying degrees of arousal depending on the activity and concentration. Those components could be diverted to a trap for collection and subsequent identification.

It appears that in the intervening 25 years, the major improvement has been the use of a more sophisticated biological object, capable, when assisted by a computer, of providing more channels of information.

William B. Prescott
Bound Brook, N.J.

Notice to members wishing to resign

ACS members who wish to resign their membership at the end of 1987 should do so now by letter to the ACS executive director. Bylaws specify that anyone who fails to resign by Dec. 31 will be carried on the rolls in 1988 as a member and will be responsible for dues. Failure to pay dues does not constitute a resignation.

Chemical Earnings Continue Strong Showing in Third Quarter

Marc S. Reisch, C&EN New York

Earnings of major U.S. chemical companies continued their strong growth in the third quarter, averaging 58% higher than the year-earlier period. The quarter just may have capped a string of year-to-year gains for major chemical firms as well as the major diversified companies that produce chemicals.

Even as chemical producers and oil firms charted by C&EN were putting together their rosy sales and earnings reports for shareholders, the Dow Jones Industrial Average dropped 508 points. What this may portend for 1988 is, at the very least, difficult to say.

The Dow Jones drop aside, the chemical industry registered a superb quarter. The 58% increase in earnings from the third quarter of 1986 the major chemical companies surveyed by C&EN came on a 17% growth in sales. Together they indicate that efficiency steps plus improved capacity utilization in many areas, notably plastics and even some basic chemicals, provided plenty of earnings leverage. Average profit margins slipped only slightly from 7.0% in the second quarter of this year.

Still, certain major chemical markets—specifically agriculture, construction, and automobiles—continue to sag. In agriculture, an overabundance of basic raw materials for the production of fertilizer has forced continuing industry realignment and prices continue to

Chemical industry leaders for the third quarter . . .

Sales

Rank 1987		$ Millions	Rank 1986
1	Dow Chemical	$3357.0	1
2	Monsanto	1902.0	2
3	Union Carbide	1730.0	3
4	W. R. Grace	1100.6	5
5	American Cyanamid	1039.0	4
6	Hercules	653.9	6
7	National Distillers	617.2	12
8	B. F. Goodrich	564.0	7
9	Air Products	543.6	8
10	Rohm & Haas	540.9	9

Earnings[a]

	$ Millions	Rank 1986
Dow Chemical	$330.0	1
Monsanto	100.0	2
Union Carbide	74.0	6
American Cyanamid	54.7	5
Freeport-McMoRan	53.9	13
Hercules	50.3	3
Ethyl Corp.	46.3	4
W. R. Grace	41.0	16
Rohm & Haas	39.3	7
Air Products	39.1	8

Profitability

	Earnings as % of sales	Rank 1986
Freeport-McMoRan	20.5%	3
Georgia Gulf	15.8	13
International Flavors	14.5	1
Vista Chemical	10.8	11
Betz Laboratories	10.8	4
Ethyl Corp.	10.5	2
Dow Chemical	9.8	14
Loctite	9.4	6
Nalco Chemical	9.4	5
Aristech	7.8	8

. . . and for the first nine months of 1987

Sales

Rank 1987		$ Millions	Rank 1986
1	Dow Chemical	$6851.0	1
2	Monsanto	5793.0	2
3	Union Carbide	5069.0	3
4	W. R. Grace	3210.6	5
5	American Cyanamid	3140.8	4
6	Air Products	2132.2	8
7	Hercules	2006.3	7
8	National Distillers	1824.5	11
9	Rohm & Haas	1671.3	9
10	B. F. Goodrich	1600.7	6

Earnings[a]

	$ Millions	Rank 1986
Dow Chemical	$891.0	1
Monsanto	392.0	2
Union Carbide	209.0	8
American Cyanamid	203.8	5
Freeport-McMoRan	190.1	4
Air Products	159.7	6
Hercules	158.9	3
Rohm & Haas	158.8	9
Ethyl Corp.	140.4	7
W. R. Grace	88.6	20

Profitability

	Earnings as % of sales	Rank 1986
Freeport-McMoRan	23.9%	1
International Flavors	15.1	2
Dow Chemical	13.0	6
Ethyl Corp.	11.2	3
Georgia Gulf	11.2	14
Betz Laboratories	10.7	4
Loctite	9.7	7
Nalco Chemical	9.5	8
Rohm & Haas	9.5	11
Vista Chemical	8.0	16

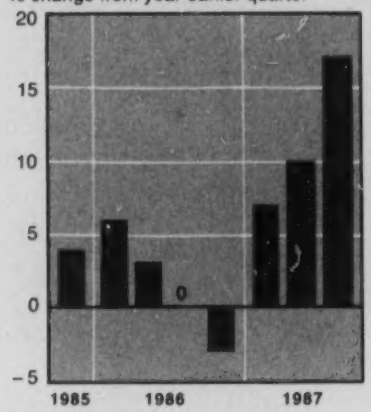
Note: For 30 chemical companies listed on page 12. a After taxes

Chemical industry 1987 third-quarter results

- Sales increased 17%
- Earnings jumped 58%
- Profit margins at 6.9%
- Production rose 7.4%
- Prices moved up 5.4%

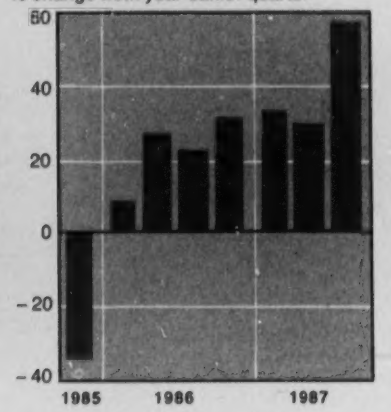
Sales

% change from year-earlier quarter



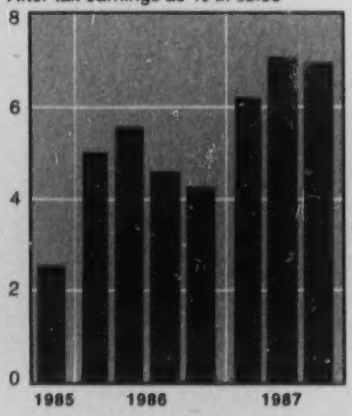
Earnings

% change from year-earlier quarter



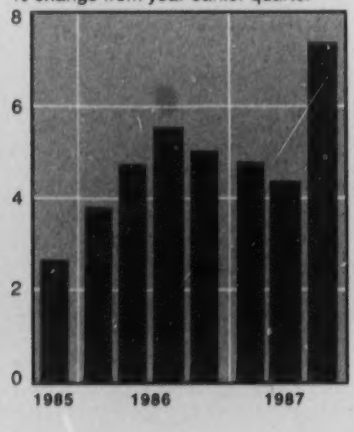
Profit margins

After-tax earnings as % of sales



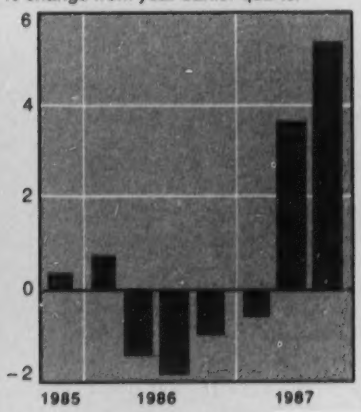
Production

% change from year-earlier quarter



Prices

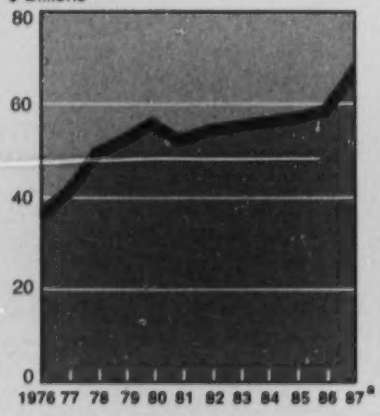
% change from year-earlier quarter



Sales this year will increase about 12% and earnings will climb about 40%, boosting profit margins to more than 6%

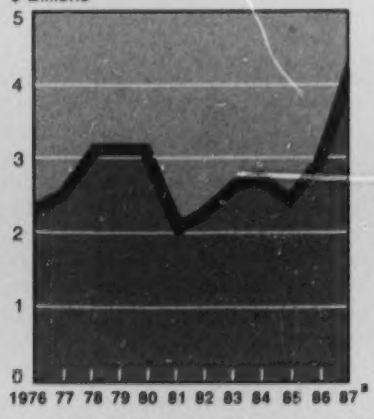
Annual sales

$ Billions



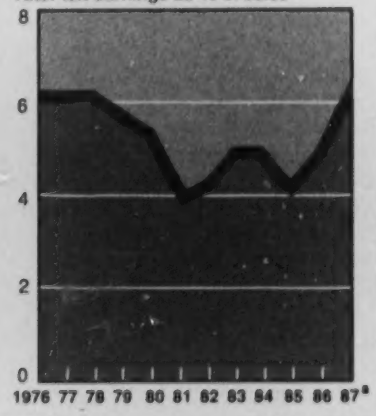
Annual earnings

$ Billions



Annual profit margins

After-tax earnings as % of sales



Note: All sales, earnings, and profit-margin data are based on combined results of 30 companies listed on page 12. a C&EN estimates.

Sales and earnings soar for major chemical companies in the third quarter

	THIRD-QUARTER 1987						NINE-MONTHS 1987			
	Sales ($ millions)	Earnings[a]	Change from 1986 Sales	Change from 1986 Earnings[a]	Profit margin[b] 1987	Profit margin[b] 1986	Sales ($ millions)	Earnings[a]	Change from 1986 Sales	Change from 1986 Earnings[a]
Air Products[c]	$ 543.6	$ 39.1	11%	13%	7.2%	7.1%	$ 2,132.2	$ 159.7	10%	31%
American Cyanamid[c]	1,039.0	54.7	13	22	5.3	4.9	3,140.8	203.8	10	36
Aristech	239.7	18.7	28	30	7.8	7.7	676.9	48.3	18	49
Betz Laboratories	100.1	10.8	14	12	10.8	11.0	286.1	30.6	10	8
Cabot Corp.[c]	na	na	na	na	na	4.3	na	na	na	na
Chemed	101.4	6.1	7	46	6.0	4.4	291.4	15.6	9	38
Crompton & Knowles	58.6	2.7	16	40	4.5	3.8	179.2	8.7	12	34
Dow Chemical[c,d]	3,357.0	330.0	22	94	9.8	6.2	6,851.0	891.0	9	56
Ethyl Corp.[c]	440.5	46.3	9	−4	10.5	12.0	1,249.7	140.4	5	6
First Mississippi	79.1	5.8	43	def	7.3	def	240.5	17.8	30	323
Freeport-McMoRan	262.3	53.9	99	258	20.5	11.4	794.0	190.1	73	23
H. B. Fuller	155.1	7.9	14	39	5.1	4.2	443.8	18.5	14	35
Georgia Gulf	176.4	27.9	28	195	15.8	6.9	505.6	56.7	15	105
B. F. Goodrich[c]	564.0	28.8	−2	110	5.1	2.4	1,600.7	63.5	−22	31,650
W. R. Grace[c]	1,100.6	41.0	22	198	3.7	1.5	3,210.6	88.6	20	228
Hercules[c]	653.9	50.3	2	−5	7.7	8.3	2,006.3	158.9	2	−15
International Flavors	187.7	27.1	14	20	14.5	13.7	566.6	85.7	19	25
International Minerals[c]	424.7	19.5	25	def	4.6	def	1,341.2	40.7	13	def
Loctite	94.0	8.8	33	45	9.4	8.6	280.1	27.1	32	42
Lubrizol	236.5	15.4	2	−13	6.5	7.6	778.1	58.1	1	7
Monsanto[c]	1,902.0	100.0	12	23	5.3	4.8	5,793.0	392.0	9	13
Nalco Chemical	216.9	20.3	18	22	9.4	9.0	611.2	58.2	12	22
National Distillers[c]	617.2	27.6	73	922	4.5	0.8	1,824.5	78.5	54	207
Olin[c]	468.5	14.9	14	73	3.2	2.1	1,427.1	61.6	8	−8
Pennwalt	294.1	9.4	8	−33	3.2	5.1	882.5	35.5	7	−10
Petrolite	68.1	3.7	7	62	5.4	3.6	200.6	11.8	−6	−15
Rohm & Haas[c]	540.9	39.3	11	5	7.3	7.6	1,671.3	158.8	5	46
Union Carbide[c]	1,730.0	74.0	11	76	4.3	2.7	5,069.0	209.0	7	80
Vista Chemical	166.6	18.1	19	76	10.8	7.4	608.9	48.5	11	61
Witco[c]	368.8	17.7	9	3	4.8	5.1	1,059.2	50.3	3	3
Total 15 largest companies	$13,750.6	$ 883.1	16%	58%	6.4%	4.7%	$38,376.8	$2696.8	9%	42%
Second 15 companies	$ 2,436.5	$ 236.6	21%	58%	9.7%	7.5%	$ 7,345.4	$ 711.1	16%	29%
GRAND TOTAL	$16,187.1	$1,119.7	17%	58%	6.9%	5.1%	$45,721.9	$3407.9	10%	39%

a Earnings from continuing operations, excluding major nonrecurring and extraordinary items. b Earnings as a percentage of sales. c One of the 15 largest companies. d Averages for 12-month running data do not include Dow Chemical, where figures include a major nonrecurring item, and Aristech and Vista Chemical, for which not all figures are available. def = deficit. na = not available.

decline. Farmers are cultivating fewer acres domestically and more pesticides are being banned from use, hurting pesticide sales. In addition, as pesticide producers develop more potent agents, use per acre will drop, leading to an overall decline in the volume of pesticide production.

New housing permits have been declining since the beginning of the year, according to the Department of Commerce. Though interest rates have recently moderated, offering some hope of new construction activity in the months ahead, the wait-and-see attitude many have adopted because of the recent decline of the stock market may just offset the advantage of lower interest rates.

The Commerce Department also reports that auto output was down in the first half of the year and auto dealer inventories remain high. As a result chemical sales to auto makers may continue to dampen, especially since the much heralded all-plastic-body cars still appear to be years away. However, Chrysler and Ford recently announced plans to step up exports of U.S.-made autos to Europe and Japan by next year to take advantage of the weak U.S. dollar, and chemical makers may benefit from this increase in business.

Despite this litany of drawbacks, which may mean more in the months ahead than for the quarter just passed, production of chemicals and allied products increased 7.4% in the third quarter compared with the year-earlier quarter. The third quarter was not the normal lackluster quarter that past experience would have indicated. Instead, it was the best quarterly output over the past two years.

Prices performed even better. Prices of chemicals and allied prod-

NINE-MONTHS 1987		12-MONTH RUNNING DATA			
Profit margin[b]		Change from 1986		Profit margin[b]	
1987	1986	Sales	Earnings	1987	1986
7.5%	7.4%	8%	−10%	7.5%	9.0%
6.5	5.2	9	13	6.1	5.8
7.1	5.7	na	na	na	na
10.7	10.9	5	−19	10.2	13.2
na	4.8	na	na	na	def
5.4	4.2	−4	−17	5.0	5.9
4.8	4.0	−4	3	4.6	4.3
13.0	9.1	10	190	8.4	3.2
11.2	11.1	5	−5	11.3	12.6
7.4	2.3	17	161	5.9	2.7
23.9	33.8	56	36	11.1	12.7
4.2	3.5	16	8	4.1	4.3
11.2	6.3	11	51	10.5	7.7
4.0	0.0	−26	def	4.0	def
2.8	1.0	15	−29	1.3	2.1
7.9	9.5	1	−8	7.0	8.5
15.1	14.5	19	1	14.4	17.0
3.0	def	12	def	1.8	def
9.7	9.0	31	14	9.3	10.6
7.5	7.0	2	−8	7.2	8.0
6.8	6.5	4	65	5.6	3.6
9.5	8.7	9	−10	8.9	10.9
4.3	2.2	1	41	4.6	3.3
4.3	5.1	6	10	3.7	3.6
4.0	4.8	7	61	4.1	2.8
5.9	6.5	−9	−32	5.8	7.7
9.5	6.8	3	2	9.1	9.2
4.1	2.4	5	30	3.3	2.7
8.0					
4.7	4.7	1	−18	4.7	5.8
7.0%	5.4%	5%	51%	5.9%	4.1%
9.7%	8.7%	12%	9%	8.1%	8.3%
7.5%	5.9%	8%	42%	6.1%	4.6%

Ground rules for C&EN earnings analysis

C&EN's quarterly report on financial performance of the U.S. chemical industry contains data from the 30 largest U.S. basic chemical companies and from 32 oil and diversified companies, each with more than $200 million in annual chemical sales.

To be included in the table of basic chemical producers, a company must have at least 50% of its sales in chemicals. That is why Du Pont, for example, is included in the table of diversified manufacturers.

In referring to chemical sales, C&EN means those chemicals whose molecular composition has been changed in the course of manufacture. Hence, chemical sales include those of traditional categories of basic petrochemicals and inorganics, organic intermediates and inorganic compounds, polymers such as plastics and fibers, agricultural chemicals, and specialty derivatives.

In listing earnings, the survey gives after-tax income for continuing operations before nonrecurring items and extraordinary charges. Foreign currency translations are included.

ucts rose 5.4% from last year's third quarter, according to the Department of Labor. This compares with an increase of 3.6% in the second quarter and a decline of 0.6% in the first quarter. These improvements in prices have gone a long way toward improving earnings leverage in the third quarter despite some small increases in petroleum feedstock prices.

The higher production and prices translate into higher earnings and sales for the chemical industry. For 29 of the 30 major chemical companies surveyed by C&EN (Cabot Corp. had not reported by press time), combined earnings increased 58% from last year's third quarter to a total of $1.12 billion. Composite sales increased to $16.2 billion. The average profit margin (earnings as a percentage of sales) for the 29 firms increased to 6.9% in the third quarter from 5.1% in third-quarter 1986. This is down only marginally from 7.0% in the second quarter, but was still much better than the 6.2% recorded in the first quarter of the year.

The larger companies improved their earnings at the same rate as the smaller companies. For the 14 large chemical companies surveyed, earnings rose an average 58% compared with the same 14 firms' earnings in last year's third quarter to a combined total of $883 million. Sales for these firms increased 16% to $13.8 billion. Their combined profit margin increased to 6.4% from 4.7% in last year's third quarter.

For the 15 smaller firms, earnings also increased an average 58%. Earnings reached a combined total of $237 million, and sales rose 21% to a total of $2.4 billion. Their average profit margin, 9.7%, surpassed that for the 14 larger firms.

For the first nine months, combined earnings for the 29 chemical companies increased 39% from the same period in 1986 to a total of $3.4 billion. Combined sales rose 10% to $45.7 billion. Average profit margin for the group for the first nine months increased to 7.5% from 5.9% in the year-earlier period.

For the 14 larger firms, combined earnings for the first nine months advanced 42% compared with the year-earlier period to a total of $2.7 billion, reflecting large gains particularly in the second quarter of 1987. Sales rose 9% for the group to $38.4 billion; profit margins increased to an average of 7.0% from 5.4% in the first nine months of 1986.

For the 15 smaller firms, earnings during the first nine months grew 29% to a combined $711 million. Sales rose 16% to a total of $7.3 billion, and profit margins for the group were up to a healthy 9.7% from 8.7% in the year-earlier period.

The strong third quarter benefited a number of highly leveraged companies that rely heavily on sales of commodity chemicals to finance their outstanding debt servicing costs. According to James R. Kuse, chairman and president of Georgia Gulf, "Sales volumes are historically high, overall inventories low, and our plants are running at or near capacity levels—all of which indicate the potential for another strong quarter." Vista Chemical's president and chief executive officer John D. Burns was equally elated with third-quarter results. The company's im-

Chemical earnings still rising at oil companies

Despite some improvement in the price they receive per barrel of oil, oil companies continue to suffer from low margins in their refining and marketing business sectors. However, their chemical operations again came to the rescue, as they have for the past year, providing solid earnings and profit margins that helped to keep oil companies in the black.

At six of the oil firms surveyed by C&EN that also report net income from chemical operations, moderate raw material prices and higher demand for petrochemicals pushed up earnings in the third quarter. Those six—Amoco, Chevron, Exxon, Mobil, Shell, and Texaco—reported earnings increases ranging from 10 to 407% for the quarter compared with the year-earlier period. Results for the six were also impressive for the first nine months, as earnings increased between 28 and 141% for members of the group.

Texaco, still enmeshed in a fight with Pennzoil over the takeover of Getty Oil, recorded a 33% drop in earnings overall to $106 million. Nevertheless, Texaco managed a 10% increase in its chemical sector earnings to $23 million in the third quarter. It did considerably better in the first nine months; earnings at $50 million were up 28%.

Exxon, the world's largest oil company, recorded a modest 1% increase in earnings for the third quarter to $1.1 billion. Its chemical operations contributed $152 million to this amount, a 33% increase from third-quarter 1986. For the first nine months, Exxon's chemical operations were running well ahead of the same period last year, producing earnings of $563 million, up 60%. Exxon chairman L. G. Rawl attributed the strong showing of the company's chemical operations in particular to demand for olefins, aromatics, and plastics.

Chevron made the most spectacular showing in the third quarter among the six with earnings up 407% to $66 million. "This dramatic improvement," says Chevron chairman George M.

EARNINGS ON CHEMICAL OPERATIONS

	Third quarter			Nine months		
$ Millions	1987	1986	% change	1987	1986	% change
Amoco	$113	$ 63	79%	$305	$205	49%
Chevron	66	13	407	181	75	141
Exxon	152	114	33	563	352	60
Mobil	92	38	142	210	102	106
Shell	131	53	147	272	201	35
Texaco	23	21	10	50	39	28

Everything.

*Trademark of The Dow Chemical Company

Keller, "is primarily due to ongoing industrywide high sales margins associated with industrial chemicals, coupled with strong demand."

Amoco registered an earnings gain of 79% to $113 million for the quarter. Amoco chairman and chief executive officer Richard M. Morrow noted the strength of worldwide demand for chemicals, as well as favorable results for synthetic fabrics and fibers included in the company's chemical earnings.

At Mobil, chemical earnings increased 142% for the quarter. Company earnings as a whole, however, slipped 4%. Higher margins for polyethylene and polystyrene were largely credited with the chemical operations' strong performance. The company also reported improved plastics business due to both increased volumes and margins for oriented polypropylene films.

proved performance "was a result of the strong markets for all Vista Chemical's products."

Borden Chemical also reported strong commodity sales. According to R. J. Ventres, chairman and chief executive officer of Borden, the parent company, "Customer demand continued strong for polyvinyl chloride resins, leading to higher selling prices and operating income more than double last year's level. Basic chemicals more than tripled in operating income, also reflecting stronger volume and pricing."

Old-line chemical companies performed well, too. At Rohm & Haas, for instance, chairman Vincent L. Gregory Jr. notes that "The pace of business activity in the worldwide chemical industry picked up during the third quarter." In particular, he says, it benefited Rohm & Haas' "polymers, resins and monomers, and plastics segments in the North American, European, and Pacific regions." Unlike petrochemical producers who were in a position to take advantage of increased volume, Rohm & Haas was caught between the prices it paid for feedstock and the prices at which it sells its production. "Offsetting favorable effects of higher volumes were sharp increases in the prices paid for petrochemical feedstocks. As a result, there was shrinkage in our gross profit margin," he says.

More integrated producers had a solid quarter. Du Pont attributed its strong third-quarter showing to demand in such areas as fibers, agricultural, and industrial chemicals and coal, as well as "substantially improved results from upstream petroleum." Du Pont, like much of the rest of the chemical industry, continued to benefit from cost and productivity improvements. According to company chairman Richard E. Heckert, "Third-quarter results demonstrate the ongoing benefit of programs to improve productivity and lower costs."

Continuing weakness in the U.S. dollar also contributed significant-

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CIRCLE 19 ON READER SERVICE CARD

Earnings improve at many oil firms, and are still rising at most diversified companies

	THIRD-QUARTER 1987						NINE-MONTHS 1987					
	Sales	Earnings[a]	Change from 1986		Profit margin[b]		Sales	Earnings[a]	Change from 1986		Profit margin[b]	
	($ millions)		Sales	Earnings	1987	1986	($ millions)		Sales	Earnings	1987	1986
OIL AND GAS COMPANIES												
American Petrofina	$ 662.5	$ 21.2	37%	274%	3.2%	1.2%	$ 1,812.4	$ 69.7	24%	def	3.8%	def
Amoco	5,164.0	412.0	30	135	8.0	4.4	14,866.0	983.0	7	69%	6.6	4.2%
Ashland	2,047.9	62.5	27	82	3.1	2.1	6,870.9	121.0	−2	−42	1.8	3.0
Atlantic Richfield	4,397.0	315.0	24	209	7.2	2.9	12,244.0	884.0	8	60	7.2	4.8
Chevron	7,700.0	194.0	31	2	2.5	3.2	21,800.0	488.0	2	−34	2.2	3.5
Exxon	21,933.0	1065.0	28	1	4.9	6.1	61,530.0	3285.0	7	−15	5.3	6.8
Kerr-McGee	693.8	21.7	15	def	3.1	def	1,967.0	69.2	1	377	3.5	0.7
Mobil	12,725.0	319.0	30	−4	2.5	3.4	35,643.0	875.0	11	−35	2.5	4.2
Occidental Petroleum	4,222.0	46.0	14	18	1.1	1.0	12,707.0	182.0	14	20	1.4	1.4
Phillips Petroleum	2,800.0	31.0	28	def	1.1	def	7,900.0	2.0	3	−99	0	2.8
Shell Oil	5,654.0	420.0	41	216	7.4	3.3	15,334.0	795.0	19	27	5.2	4.9
Sun Co.	2,470.0	75.0	3	9	3.0	2.9	7,080.0	175.0	−14	−43	2.5	3.7
Texaco	9,000.0	108.0	23	−33	1.2	2.2	26,000.0	355.0	5	−47	1.4	2.7
DIVERSIFIED COMPANIES												
Allied-Signal	2,679.0	92.0	10	−38	3.4	6.1	8,162.0	283.0	11	−37	3.5	6.1
Borden	1,680.0	79.0	32	20	4.7	5.2	4,710.2	185.7	29	20	3.9	4.2
Dexter	193.3	10.2	23	23	5.3	5.3	582.0	32.1	20	26	5.5	5.2
Du Pont	7,585.0	421.0	19	31	5.6	5.0	22,527.0	1199.0	10	1	5.3	5.8
Eastman Kodak	3,913.8	396.1	12	51	10.1	7.5	9,776.0	936.0	15	213	9.6	3.5
Eli Lilly	957.7	150.0	8	11	15.7	15.3	3,034.3	505.5	10	17	16.7	15.8
Emhart	558.3	23.3	18	def	4.2	def	1,789.9	71.5	19	20	4.0	4.0
Engelhard	612.3	14.7	8	21	2.4	2.1	1,751.1	46.3	10	19	2.6	2.5
FMC	730.0	26.8	10	0	3.7	4.0	2,282.8	91.0	3	−11	4.0	4.6
GAF	222.5	31.6	13	29	14.2	12.4	627.8	81.9	10	33	13.0	10.8
Kaiser Tech[c]	523.1	11.9	0	def	2.3	def	1,530.8	−380.7	3	def	def	def
Koppers	434.6	33.1	0	8	7.6	7.0	1,095.4	54.2	3	13	4.9	4.5
Merck	1,306.5	237.6	24	37	18.2	16.4	3,666.9	674.0	23	34	18.4	16.9
3M	2,466.0	249.0	10	16	10.1	9.6	7,054.0	702.0	9	18	10.0	9.2
Morton-Thiokol	557.9	36.4	14	21	6.5	6.1	1,987.3	138.0	2	4	6.9	6.8
PPG Industries	1,260.0	91.3	11	11	7.2	7.2	3,850.0	280.6	12	15	7.3	7.1
Pfizer	1,297.9	185.8	12	5	14.3	15.2	3,644.6	521.7	10	4	14.3	15.1
Tyler	282.6	5.7	15	46	2.0	1.6	816.3	11.9	13	31	1.5	1.3
Vulcan Materials	295.4	38.7	12	5	13.1	13.9	793.1	88.8	10	14	11.2	10.8

a From continuing operations excluding major nonrecurring and extraordinary items. b Earnings as a percentage of sales. c Includes nonrecurring item. **def** = deficit.

ly to the results for a number of companies included in C&EN's quarterly survey. J. Peter Grace, chairman, president, and chief executive officer of W. R. Grace, says that Grace's specialty chemical company posted gains in physical volume and earnings. Higher income for the unit reflects "the translation effect of the U.S. dollar and improved operating results in Europe, the Pacific region, and in the company's interamerican division."

3M chairman Allen F. Jacobson says that improved earnings at his company also may be attributed to, as he put it, "the more properly valued U.S. dollar," as well as to "an acceleration of our U.S. volume growth, efforts to control costs and assets, and a lower effective tax rate."

Monsanto chairman and chief executive officer Richard J. Mahoney says the company's crop chemicals sales continue to benefit "from the increasing worldwide demand for Roundup herbicide, reflecting the successful implementation of new marketing strategies for that product."

Among the strongest performers for the quarter and indeed for the year was Dow Chemical. According to Dow chairman and chief executive officer Paul F. Oreffice, "Basic chemicals and plastics showed exceptional gains, with continued good balance between supply and demand. Major contributors among basic chemicals included vinyl chloride monomer, chlorine, and caustic. In basic plastics, polyethylene and polystyrene continued to experience strong demand and increasing margins."

The Dow chief also discounted as premature rumors of the decline of the chemical business owing to Wall Street's recent gyrations. "We expect our business to remain strong during the fourth quarter," he says. "This momentum will continue into 1988." □

Pesticides Growth Slows

William J. Storck, C&EN New York

Biologist prepares tobacco hornworms for bioassay of biological insecticide

The pesticide business hasn't fallen on hard times, but it isn't the business it used to be. Only a few years ago, many nonpesticide producers were looking with longing at the high profit margins being garnered by pesticide makers. Companies let it be known that they were actively seeking to acquire pesticide businesses, but usually the price was too high. Development of pesticides was a booming business, with each new product being hailed as the ultimate in ridding the world of a particular pest.

Pesticides producers seemed to be almost coining money. Even though the risks were high, R&D soaked up a lot of money, field trials could take years, and the patent protection of an approved pesticide might last for only an average of seven years after introduction, makers could recoup their investment easily. And for some of the major pesticides producers, after-tax profit margins averaged 30 to 40%.

But those days of unending optimism in the industry are over. Companies, like their customers, the farmers, are faced with the realities of the agricultural economy. Despite government programs to cut inventories of farm products, surpluses persist. They are holding down the prices that farmers can receive for their goods and, consequently, are holding increases in farm income in check.

The number of planted acres is down, causing a decline in the amounts of pesticides used. And there are fewer pounds of pesticides used per acre of cropland.

Also there is an increased awareness among farmers—and among pesticides manufacturers—of the safety and environmental consequences of pesticide use. Farmers over the years have been relatively complacent regarding the issue of pesticides and their own health and the health of the environment. This, like so many other factors that farmers face, has been largely a matter of economics. Farmers have felt that their income depended on maximizing output per acre, and pesticides as well as fertilizers and other inputs were all part of that effort. Consequently, farmers tended to take an "overkill" approach to pest management. They often put on more, indeed sometimes much more, pesticide than was necessary to ensure the absolute destruction of pest populations.

In examining the cost of their inputs, however, farmers now have learned that additional pesticides may not be worth the increased cost per acre. And this has been coupled

Pesticides demand slows in U.S.

$ millions	1970	1986	1990	1995	% annual change 1970–85	% annual change 1985–90
Herbicides	$413	$2675	$3470	$4420	13.3%	5.3%
Insecticides	286	1360	1700	2100	11.0	4.6
Fungicides	120	365	450	555	7.7	4.3
Other Pesticides	83	300	380	475	8.9	4.8
Nematicides	21	85	110	142	9.8	5.3
Rodenticides	13	50	64	81	9.4	5.1
Defoliants/dessicants	10	45	55	67	10.5	4.1
Fumigants	22	40	47	55	4.1	3.3
Other	17	80	104	130	10.9	5.4
TOTAL	$902	$4700	$6000	$7550	11.6%	5.0%

Source: Freedonia Group

with an increasing environmental and safety awareness among farmers who have seen some of their most frequently used pesticides banned or restricted by environmental pressures.

Last year, *Farm Journal*, a leading agricultural trade magazine, commissioned a study to be conducted by the University of Iowa's Institute of Agricultural Medicine to determine chemical contamination of farmers during the 1986 corn-planting season. Pre-exposure urine samples from 22 farmers in the study showed no contamination. But post-exposure urine samples in some of the farmers--depending on the type of insecticide used—did show low levels of contamination.

The reactions of the farmers are interesting. Most thought that they were being very careful. One is quoted as saying, "I've tried to be a careful handler and did not think I would show up on this test. I use a surgeon's mask and gloves and farm only 275 acres now, but it shows how easy it is to get contaminated." Others tried to pinpoint the cause, saying that, precautions aside, it is very easy to inhale the pesticide or to get it on the skin while handling it.

Donald Morgan, the professor at the Institute of Agricultural Medicine who designed the study, said, "In my experience, it has been unusual circumstances that have led to serious poisonings, rather than well-ordered operations. Broken equipment, spills left unattended, contaminated clothing, skin contact with drips and hoppers during repair—all have led to poisonings. As in so many occupational hazard situations, it is constant vigilance that contributes most to overall safety."

The probability of groundwater contamination also is finding its way into agricultural publications. In August, *Agricultural Resources*, a publication of the U.S. Department of Agriculture's Economic Research Service, published an article entitled "Agriculture's Impact on Water Quality," which does not make any allegations of specific contamination, but rather discusses some of the economic impacts that could occur if certain pesticides were banned from agricultural use. For instance, the article says, "At the national level, widespread changes in agricultural production could affect the market prices of crops. For example, the triazine herbicides, widely used on corn, will be looked for in the [Environmental Protection Agency] survey of pesticides in well water. If these pesticides were banned, corn yields would decrease an estimated average of 8%, raising prices about 31%."

Another USDA publication, *Agricultural Outlook*, this month advises farmers about methods to prevent agricultural pollution of coastal waters from pesticides as well as fertilizer and soil runoff.

This past spring *Farm Journal* tried to make farmers aware of the consequences of groundwater contamination by citing the case of a farmer whose well water was contaminated by pesticides and the resultant economic and emotional impacts on his life.

Other than more careful use, the sheer economics of farm life are cutting into pesticides producers' markets.

Cropland acreage planted this year declined to about 330 million acres, down about 8% from 1986 and off almost 14% from the decade high of 383 million acres in 1982, according to USDA. Further, USDA says, the largest decline—almost 10.6 million acres or about 40% of the total decline—was for corn, the major user of herbicides and insecticides. As a result, total 198[illegible] farm pesticide use is projected at 430 million lb of pesticide active ingredients, down 9% from last year.

In looking at other inputs, farmers have learned to be more efficient. Rising costs in the mid- to late 1970s gave farmers an education in managing their inputs that they have not forgotten. The increased cost of just about every product that they had to buy (it has been facetiously said that the American farmer is the only businessman who buys at retail and sells at wholesale) forced farmers to re-evaluate just about every sector of their operations. During this period, no-till farming (cropland is not turned under in preparation for planting) or limited-till farming came into practice. The idea was to reduce the number of trips the

Croplands are sprayed with pesticides

Sandoz Crop Protection photo

Tobacco hornworms are used to test potential insecticide candidates

tractor had to make across the field, thus conserving fuel. This concept also resulted in reduced applications of fertilizers and pesticides.

These are cost-cutting practices farmers have not given up, but indeed are extending whenever possible.

According to the U.S. International Trade Commission, shipments of pesticides in 1985 totaled about 1.02 billion lb of active ingredients. This was 14% below the 1986 level and almost 28% below 1985, when the industry peaked at 1.41 billion lb. Although ITC has not yet published figures for 1986, shipments likely recovered and may have reached 1.10 billion lb.

ITC says prices of pesticides generally have increased, more than doubling between 1976 and 1985. However, estimates are that prices declined slightly, probably less than 1%, between 1985 and 1986.

Value of shipments of pesticides has increased 84% between 1976 and 1985, when the value hit $4.44 billion. Most of this growth occurred between 1976 and 1981. Since 1981, the value of shipments has generally trended down except for a large spike in 1984 when it peaked at $4.73 billion. Estimates are that value fell a little more in 1986 to about $4.25 billion.

Against this backdrop then, it is no wonder that makers of agricultural chemicals are saying that the industry is not going to enjoy the growth it once saw.

One of the more optimistic market studies of pesticides has been carried out by Freedonia Group, a

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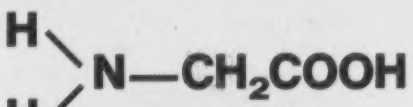

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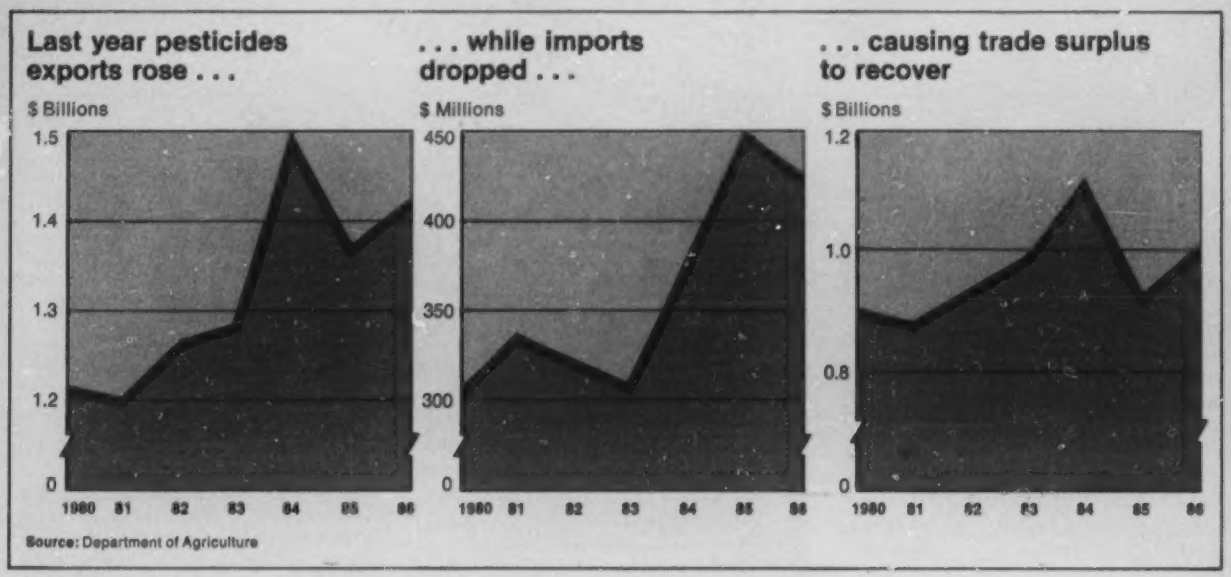

market research firm based in Cleveland Heights, Ohio. This study shows pesticide demand in dollar volume growing at 5.0% per year between 1985 and 1990. However, this is a slowing from an 11.6% annual average growth rate between 1970 and 1985. For agricultural use of pesticides, the projected growth rate over the 1985–90 period is again 5.0% per year, down from 11.2% annually between 1970 and 1985.

Growth in pesticide use, the study says, will be based on favorable economic factors, moderate agricultural advances, and continued technological innovation. But, it adds, because of more efficient formulations, volume demand for pesticides will drop slightly. The study also says that biological control measures such as the use of resistant crop varieties and natural predators will not replace pesticides in the next decade.

Herbicides will exhibit the most rapid growth over the next five years (about 5.3% per year to $3.47 billion), aided by technological advances, according to the study. Corn and soybean producers will remain the two largest markets. High-activity products based on new chemistries have been developed that permit significantly lower application rates, employ different modes of action, and improve environmental safety. The study particularly cites American Cyanamid's imidazolinones—Arsenal, Scepter, and Assert—and Du Pont's sulfonylureas—Glean, Escort, and Harmony—as examples.

The study says that insecticides and fungicides will have more limited markets and fewer technological breakthroughs than will herbicides. Competitive pressures will force insecticide producers to fund research activity to develop new generations of synthetic pyrethroids and to seek acquisitions in order to broaden markets. Development of a new breed of fungicides known as sterile inhibitors is expected to have a significant impact on fungicide markets. Sterile inhibitors stop fungal attack and provide residual protection with fewer applications.

A more pessimistic view is offered in a study by Frost & Sullivan, the New York City-based market research firm. It says that the size of the agricultural chemicals market is unlikely to change appreciably during this decade. The Frost & Sullivan study indicates that since virtually all planters who might use agricultural chemicals are already using them, growth would require an increase in planted acreage. And, the study points out, such acreage might decline over the next few years because of foreign demand reductions or supply increases, breakthroughs in agricultural productivity, or further declines in U.S. consumption of meat, which is a relatively expensive food in terms of planted acreage support required.

And there will be factors other than gross demand shifts that will affect the pesticides industry in coming years, according to the study. For instance, the ending of patent protection for many major products will mean a rapid shift from a proprietary market structure to one subject to commodity competition. This will mean increased direct competition, lower prices, and lower profitability for all pesticide producers and is likely to result in increased consolidation of the industry. It may also mean an increase in the importance of formulators.

The industry is already consolidating. Over the past few years, Farley/Northwest Industries has sold its Velsicol operations to Sandoz; Union Carbide's agricultural chemicals operations went to Rhône-Poulenc; Du Pont has bought Shell Chemical's pesticides operations; and BASF has purchased Rohm & Haas' Blazer herbicides business (Rohm & Haas has retained its other agricultural chemicals operations). In addition, Stauffer's agricultural chemicals business is now owned by ICI, and Diamond Shamrock's pesticides business has been taken over by Fermenta.

One other change was the acquisition of Uniroyal's agrochemicals business by Avery Inc. However, this does not reflect a consolidation—the move was mainly because

of a failed takeover attempt of Uniroyal and its subsequent selling off of assets.

Common to all these deals—except Du Pont's acquisition of the Shell business—is a foreign buyer.

This may be a coming trend, according to industry observers. Payout in the agricultural chemicals business is becoming so long-term U.S. companies may not want to take the risk. Environmental pressures have forced companies to extend their testing, and the rate of success in developing new products is dwindling. An estimated 25,000 to 30,000 compounds must be synthesized to find one commercial product. In addition, there is a reluctance in the marketplace to change from a familiar and effective product to a new product until the new pesticide has proven itself.

These factors, according to industry sources, are among the reasons that foreign companies are buying the U.S. chemical operations. Foreign companies want to get into the pesticides market and, in most cases, they are more willing to enter into long-term investments. They are willing to wait for their returns, whereas U.S. companies demand shorter-term profits. For this reason, pharmaceutical companies or chemical companies with large pharmaceutical operations, such as Eli Lilly, Ciba-Geigy, American Cyanamid, and Sandoz, are more comfortable with pesticides. These companies are thoroughly familiar with many of the strictures placed on pesticides—the testing and justification that may cost more than $20 million per compound, patent protection problems, and the wait for profits—because the strictures are also common in the drug industry.

According to a study by Technomics Publishing Co., Lancaster, Pa., of the top 10 pesticide companies in 1970, only six remained in the top 10 in 1986. Of the top 10 in 1970, only two were foreign-owned. By 1986, five were foreign-owned. Since that time, there has been further consolidation of the top 10 firms, with Du Pont's acquisition of Shell's business and ICI's purchase of the Stauffer pesticides operations.

The slowing of the pesticides industry is showing up in other ways as well. For instance, the number of new products introduced each year has declined significantly over the past 15 or so years. In the mid-1960s, the number of new compounds being registered peaked at about 40 per year. This has slowed to less than 10 per year.

Industry sources say that they are not particularly concerned by this decline because the pesticide industry has always gone through peaks and valleys in new product registrations. They point to the fact that R&D spending is probably at an all-time high in the U.S. pesticides industry, with the basic chemicals industry spending more than $850 million per year on R&D.

Even though the companies may be spending more on R&D, the question is just where is that money going? Is it going to new product development or is it going to defend products? There is no ques-

Sandoz Crop Protection photo

Bacterium used in biological insecticides is examined for potency

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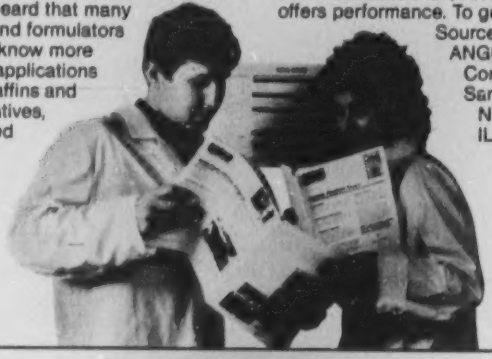

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tion that the cost of developing a new product is rising. In the past five years the "hurdle rate" to get through preregistration testing has increased because of government demands for greater toxicity testing, metabolism tests, and studies of residues, soil, and groundwater effects. As a result of delays in registration caused by the increased testing demands, the effect on profits can be enormous. For a "blockbuster" product—one rapidly accepted with high sales—a one-year delay could mean a loss of profits in millions of dollars.

Companies also must spend more to reregister products when a patent expires because the government is demanding more data than ever before. According to Will D. Carpenter, vice president, technology division, Monsanto Agricultural Co., the cost of generating these studies may be greater than the annual sales volume of the product. Because of this increased cost, he says, there is attrition of products in the marketplace. This attrition could accelerate, he adds, as testing demands increase.

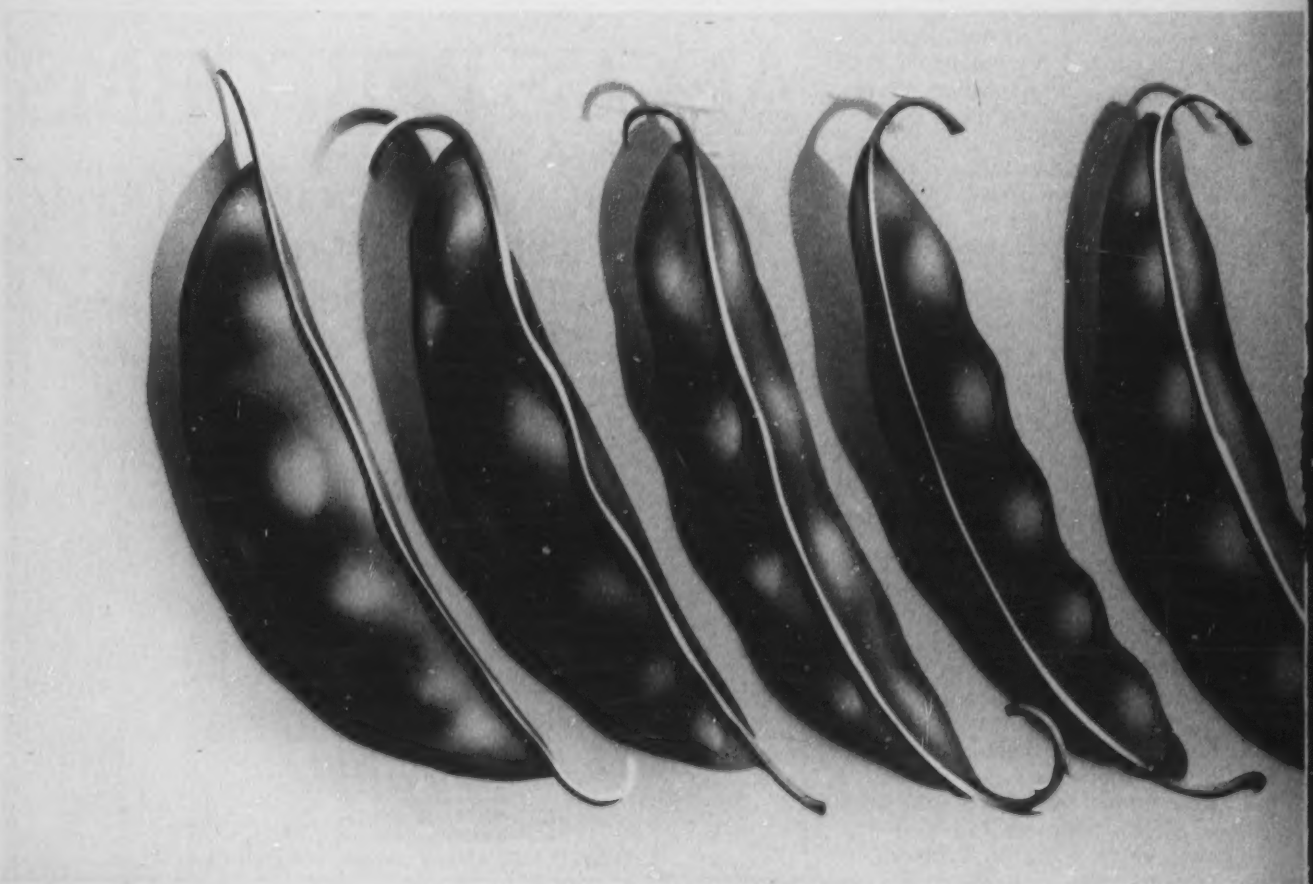
Europe takes largest share of U.S. pesticide exports

% of exports[a]	1980	1985	1984	1983	1982
Africa	3.8%	2.9%	3.8%	3.1%	3.3%
Canada	9.3	12.7	13.2	13.9	12.9
Central America	8.0	9.0	8.8	8.7	9.5
South America	15.9	12.0	13.0	13.3	12.5
Asia	22.9	22.9	22.5	22.8	22.6
Western Europe	35.3	36.0	33.4	32.4	35.1
Eastern Europe	0.9	0.6	0.2	0.3	0.4
Oceania	3.8	4.0	5.1	5.5	3.6

[a] Totals may not add up to 100 because of rounding. Source: Department of Agriculture

Thus, manufacturers are not considering growth; they are now worried about shrinkage. This means fewer products, fewer manufacturers, increased competition among products, and lower profits.

Dale Miller, president and chief executive officer of Sandoz Crop Protection Corp., says that some of the shrinkage stems from better educated farmers—they understand better what they need and what they don't need. Also, many of the markets expected in the 1970s have not developed. The major market anticipated was the developing countries, where there are large demands for food and fiber. Producers believed that South America, particularly Argentina and Brazil, would become a fertile market. This market did not materialize, in spite of the fact that



many South American countries are better able to feed and clothe their populations than 10 years ago. According to Miller, these countries not only learned to manage their inputs better, but they also became more efficient in bringing their crops to market.

Brazil has been importing more pesticides from the U.S., but only in the past two years. In 1986, according to USDA estimates, Brazil accounted for 5.8% of total U.S. pesticide exports, up from 3.5% in 1985, but little more than the 5.5% taken in 1983.

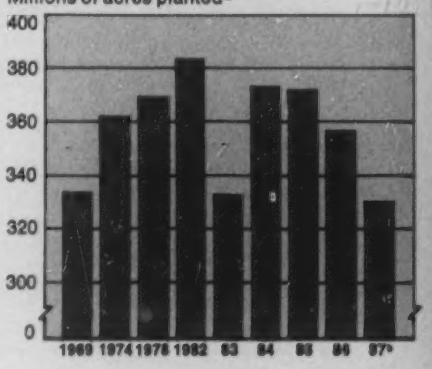
In spite of the strong dollar in the early 1980s, pesticide exports have been the bright spot of the pesticide industry. According to USDA, the value of pesticide exports increased to $1.4 billion in 1986 from $1.2 billion in 1980, peaking at $1.5 billion in 1985. Industry predictions are that exports will increase again in 1987, perhaps surpassing the 1985 level.

Herbicides represent the biggest share of pesticide exports, constituting about 44% or $625 million worth of product sent overseas. This is followed by insecticides at 36% or $513 million and fungicides at 16% or $222 million. Between 1980 and 1986, herbicides were the fastest growing segment at about 29%, followed by fungicides at 13%, and pesticides at 13%. The fastest growing subcategories were miscellaneous formulated insecticides at 135% and technical herbicide materials at 51%.

The greatest decline came in chlorinated hydrocarbon insecticides, according to USDA, exports of which fell from about $18 million in 1980 to about $1 million in 1986. The last DDT production plant closed in 1983, which, coupled with increased foreign production of related products, contributed to the decline in exports of these insecticides.

Pesticide imports also grew between 1980 and 1986, peaking again in 1986. In the 1980–86 period, imports rose 37% to $423 million with the 1985 high at $449 million. Most of this import trade is in technical material, the active ingredient for the pesticide. Formulated products make up 20% of total imports since it is cheaper to ship just the technical material. However, the value of

Land used for crops will decline again this year



a For 48 contiguous states. b Preliminary.
Source: Department of Agriculture

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formulated product imports has increased 90% over the past six years whereas imports of technical material have increased 27%.

As a result, the trade surplus in pesticides also has grown, but it peaked in 1984. From 1980 to 1986, the surplus increased 11% to $1 billion. It peaked in 1984, at $1.12 billion.

Ironically, Brazil, forecast in the 1970s to be a large market for U.S. pesticide exports, today exports a large volume of pesticides to the U.S. Although it imported about $83 million in pesticides from the U.S. in 1986, it exported about $55 million to the U.S. This made it the second largest supplier of pesticides to the U.S., trailing only West Germany. USDA, however, hints that some of this trade may be the result of transshipping products to the U.S. through Brazil, which is given favorable tariff treatment.

Exports to the Third World still figure into any equation for the future of the pesticide industry, but the equation may take a new twist. This twist involves a general trend to improved products and new formulations that dramatically reduce the amount of active ingredient needed per acre of cropland, and how industry will cope with the problem it creates.

The problem is educating the farmers. Companies have horror stories of poorly educated farmers in developing countries vastly overapplying pesticides to their crops. So there is the fear that a combination of misreading labels plus a misguided "if one ounce is good, one pound will be great" attitude will damage perhaps both the crop and the environment.

According to Monsanto's Carpenter, pesticide makers are well aware of this problem and are studying ways to avoid it. One of the ways, he says, will be to ship the product premixed. This solution has its own set of problems—economic, not environmental. Companies will largely be shipping water, and somebody will have to pay for that water. Will it be the farmer in the developing countries or will it be the chemical company? This is the unanswered question.

The next few years may see further changes in the U.S. agricultural chemicals industry. The Freedonia study says that besides the acquisitions that increase market penetration and provide research dollars, business strategies include seeking licensing agreements to offset patent expiration and high research costs. Many companies are turning to more efficient, value-added operations such as premixing of different herbicides or of herbicides with insecticides or fungicides to offset decreased sales and save time and fuel. And the industry will continue to focus on new product development with a view to finding its own niche in the marketplace.

Sandoz Crop Protection photo

Mode-of-action studies test activity of potential herbicide candidates

Changing farm technology also may have its effect. According to the Frost & Sullivan study, conservation tillage will shift use toward surface-applied pre-emergent and postemergent products and away from products that are incorporated into the soil. This shift is already under way. And Frost & Sullivan says the growing use of personal computers will enable farmers to tailor pesticide requirements to the economics of the individual operation. Again, this may be just a more sophisticated method of doing what the farmer already is doing, reviewing his inputs and streamlining wherever possible.

Most industry sources agree that in the next 10 years biotechnology-derived pesticides won't have much impact because it will take about that long for them to receive their registration. And, these sources estimate, in 20 years, only 5 to 15% of the pesticide outlay by farmers will be for biotechnology-derived products. □

Prices of most pesticides fell over past two years

$ per lb active ingredient	1987	1986	1985	% annual change 1987	% annual change 1986
HERBICIDES					
Alachlor	$4.84	$5.10	$5.15	−5.1%	−1.0%
Atrazine	2.20	2.14	2.04	2.8	4.9
Butylate	3.04	3.10	3.13	−1.9	−1.0
Cyanazine	4.62	4.55	4.55	1.5	0.0
Metolachlor	6.03	6.05	6.09	−0.3	−0.7
Trifluralin	6.30	6.25	6.43	0.8	−2.8
2, 4-D	2.44	2.26	2.38	8.0	−5.0
Composite[a]	4.05	4.05	4.06	0.0	−0.2
INSECTICIDES					
Carbaryl	3.90	3.91	3.84	−0.3	1.8
Carbofuran	9.57	10.27	10.29	−6.8	−0.2
Chlorpyrifos	8.25	8.30	8.23	−0.6	0.9
Fonofos	8.70	8.82	8.85	−1.4	−0.3
Methyl parathion	2.82	2.74	2.75	2.9	−0.4
Phorate	6.59	6.54	6.57	0.8	−0.5
Synthetic pyrethroids	48.80	51.20	54.40	−4.7	−5.9
Terbufos	9.79	9.79	9.80	0.0	−0.1
Composite[a]	10.25	10.27	10.49	−0.2	−2.1

a Includes major materials not listed. **Source:** Department of Agriculture

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